

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) An optical disc apparatus for recording or playing back optical information on an optical disc, comprising:

a convergence lens for converging an optical beam ~~that is irradiated on~~ onto the optical disc;

a light detection device, including a first detection portion and a second detection portion, ~~unit~~ operable to receive and detect the optical beam reflected by the optical disc on each ~~divided area~~ detection portion in a tracking direction, and output a first detection signal corresponding to a detected result from either one of the ~~divided areas~~ detection portions and a second detection signal corresponding to a detected result from the other detection portions ~~divided area~~;

a lens shifting unit operable to shift the light receiving area of the light detection device ~~unit~~ in a tracking direction by shifting the convergence lens in the tracking direction;

an amplifying unit operable to change a gain balance by amplifying the first and the second detection signals using independent gains respectively;

an addition unit operable to output an addition signal by adding the first detection signal to the second detection signal in response to the shift in lens position of the convergence lens and the change in gain balance made by the lens shifting unit and the amplifying unit; and

a gain balance adjustment unit operable to obtain the addition signal outputted from the addition unit, specify a gain balance that equalizes detection sensitivities of the respective ~~areas~~ detection portions in the light detection ~~unit~~ device based on the obtained result, and control the amplifying unit so as to have the amplifying unit amplify the first and the second detection signals using the ~~determined~~ specified gain balance.

2. (Currently Amended) The optical disc apparatus according to Claim 1,

wherein the gain balance adjustment unit specifies a predetermined gain balance as a gain balance that equalizes detection sensitivities of the respective ~~areas~~ detection portions in the light detection ~~unit~~ device in the case where an addition signal becomes

constant when a lens position shifts in the predetermined gain balance.

3. (Currently Amended) The optical disc apparatus according to Claim 2, further comprising:

a lens position adjustment unit operable to obtain the addition signal outputted from the addition unit, specify a lens position that equalizes sizes of ~~the respective~~ light receiving areas for receiving optical beam of the detection portions in the light detection ~~unit-device~~ based on an obtained result, and control the lens shifting unit so that the convergence lens shifts to the determined lens position.

4. (Currently Amended) The optical disc apparatus according to Claim 3,

wherein the lens position adjustment unit specifies the predetermined lens position as a lens position that equalizes sizes of the respective light receiving areas for receiving optical beam of the detection portions in the light detection ~~unit-device~~ in the case where an addition signal becomes constant when a gain balance changes at the predetermined lens position.

5. (Currently Amended) The optical disc apparatus according to Claim 4,

wherein the lens position adjustment unit specifies the predetermined lens position as a lens position that equalizes the sizes of the respective light receiving areas for receiving optical beam of the detection portions in the light detection ~~unit-device~~ in the case where a change rate of the addition signal on a gain balance becomes "0" at the predetermined lens position.

6. (Original) The optical disc apparatus according to Claim 5,

wherein the amplifying unit changes a gain balance so that an addition result of a gain of the first detection signal and a gain of the second detection signal becomes constant.

7. (Original) The optical disc apparatus according to Claim 5,

wherein the amplifying unit changes a gain of either one of the first detection

signal or the second detection signal.

8. (Currently Amended) The optical disc apparatus according to Claim 4,
wherein the amplifying unit changes the gain balance to a first gain balance and a second gain balance, and

the lens position adjustment unit shows a relation between a lens position and an addition signal in the first gain balance with function approximation, shows a relation between a lens position and an addition signal in the second gain balance with function approximation, and specifies a lens position shown by an intersection of both functions as a lens position that equalizes the sizes of the respective light receiving areas ~~for receiving the optical beam of the detection portions~~ in the light detection ~~unit~~device.

9. (Currently Amended) The optical disc apparatus according to Claim 3, further comprising:

a subtraction unit operable to output a subtraction signal by calculating the difference between the first detection signal and the second detection signal whose gain balance is adjusted by the gain balance adjustment unit;

a subtraction signal amplifying unit operable to amplify the subtraction signal;

a gain adjustment unit operable to change the gain of the subtraction signal amplifying unit in response to the addition signal outputted from the addition unit; and

a tracking control unit operable to control the lens shifting unit so that the optical beam can follow the tracks of the optical disc based on the subtraction signal amplified by the subtraction signal amplifying unit.

10. (Currently Amended) The optical disc according to Claim 2,

wherein the gain balance adjustment unit specifies the predetermined gain balance as the gain balance that equalizes the detection sensitivities in the respective areas detection portions in the light detection ~~unit~~device in the case where a change rate of the addition signal on the lens position becomes "0" in the predetermined gain balance.

11. (Currently Amended) The optical disc apparatus according to Claim 2,

wherein the lens shifting unit shifts the convergence lens to a first lens position and a second lens ~~positions~~position,

the gain balance adjustment unit shows a relation between a gain balance and an addition signal in the first lens position with function approximation, shows a relation between a gain balance and an addition signal in the second lens position with function approximation, and specifies a gain balance shown by an intersection of both functions as a gain balance that equalizes the detection sensitivities of the respective ~~areas~~detection portions in the light detection ~~unit~~device.

12. (Canceled)

13. (Currently Amended) An optical disc apparatus for recording or playing back optical information on an optical disc, comprising:

a convergence lens for converging an optical beam ~~that is irradiated on~~onto the optical disc;

a light detection device, including a first detection portion and a second detection portion, ~~unit~~ operable to receive and detect the optical beam reflected by the optical disc on each ~~divided area~~detection portion in a tracking direction, and output a first detection signal corresponding to a detected result from either one of the ~~divided areas~~detection portions and a second detection signal corresponding to a detected result from the other ~~divided area~~detection portion;

a lens shifting unit operable to shift a light receiving area in the light detection ~~unit~~device in a tracking direction by shifting the convergence lens in the tracking direction;

an amplifying unit operable to change a gain balance by amplifying the first and the second detection signals using independent gains respectively;

an addition unit operable to output an addition signal by adding the first detection signal to the second detection signal in response to the shift in lens position of the convergence lens and the change in gain balance made by the lens shifting unit and the amplifying unit; and

a lens position adjustment unit operable to obtain the addition signal outputted

from the addition unit, specify a lens position that equalizes sizes of ~~the respective~~ light receiving areas of the detection portions in the light detection ~~device unit for receiving optical beam~~ based on an obtained result, and control the lens shifting unit so that the convergence lens shifts to the determined lens position.

14. (Currently Amended) The optical disc apparatus according to Claim 13,
wherein the lens position adjustment unit specifies the predetermined lens position as the lens position that equalizes the sizes of the respective light receiving areas for receiving optical beam of the detection portions in the light detection ~~unit device~~ in the case where the addition signal becomes constant when the gain balance changes in the predetermined lens position.

15. (Currently Amended) A control device for controlling an optical head of an optical disc apparatus for recording or playing back optical information on the optical disc,

wherein the optical head comprises:

a convergence lens for converging optical beam ~~that is irradiated on~~ onto the optical disc;

a light detection device, including a first detection portion and a second detection portion, ~~unit~~ operable to receive and detect the optical beam reflected by the optical disc on each ~~divided area~~ detection portion in a tracking direction, and output a first detection signal corresponding to a detected result from either one of the ~~divided areas~~ detection portions and a second detection signal corresponding to a detected result from the other ~~divided area~~ detection portion; and

a lens shifting unit operable to shift a light receiving area in the light detection ~~unit device~~ in a tracking direction by shifting the convergence lens in the tracking direction;

wherein the control device comprises:

an amplifying unit operable to change a gain balance by amplifying the first and the second detection signals using independent gains respectively;

an addition unit operable to output an addition signal by adding the first detection

signal to the second detection signal in response to the shift in lens position of the convergence lens and the change in gain balance made by the lens shifting unit and the amplifying unit; and

a gain balance adjustment unit operable to obtain the addition signal outputted from the addition unit, specify a gain balance that equalizes detection sensitivities of the respective ~~areas~~ detection portions in the light detection ~~unit~~ device based on an obtained result, and control the amplifying unit so as to have the amplifying unit amplify the first and the second detection signals using the ~~determined~~ specified gain balance.

16. (Currently Amended) The control device according to Claim 15,

wherein the gain balance adjustment unit specifies the predetermined gain balance as a gain balance that equalizes the detection sensitivities of the respective ~~areas~~ detection portions in the light detection ~~unit~~ device in the case where the addition signal becomes constant when the lens position changes in the predetermined gain balance.

17. (Currently Amended) The control device according to Claim 16, further comprising:

a lens position adjustment unit operable to obtain the addition signal outputted from the addition unit, specify the lens position that equalizes sizes of the respective light receiving areas ~~for receiving optical beam of the detection portions~~ in the light detection ~~unit~~ device based on the obtained result, and control the ~~lens position adjustment unit~~ operable to control the lens shifting unit so that the convergence lens shifts to the determined lens position.

18. (Currently Amended) The control device according to Claim 17,

wherein the lens position adjustment unit specifies the predetermined lens position as the lens position that equalizes the sizes of the respective light receiving areas ~~for receiving optical beam of the detection portions~~ in the light detection ~~unit~~ device in the case where the addition signal becomes constant when the gain balance changes at the predetermined lens position.

19. (Currently Amended) The control device according to Claim 18,
wherein the lens position adjustment unit specifies the predetermined lens position as the lens position that equalizes the sizes of the respective light receiving areas ~~for receiving optical beam of the detection portions~~ in the light detection ~~unit~~ device in the case where a change rate of the addition signal on the gain balance becomes “0” at the predetermined lens position.

20. (Original) The control device according to Claim 19,
wherein the amplifying unit changes the gain balance so that an addition result of a gain of the first detection signal and a gain of the second detection signal becomes constant.

21. (Original) The control device according to Claim 19,
wherein the amplifying unit changes a gain of either one of the first detection signal or the second detection signal.

22. (Currently Amended) The control device according to Claim 18,
wherein the amplifying unit changes the gain balance to the first and the second gain balances,

the lens position adjustment unit shows a relation between a lens position and an addition signal in the first gain balance with function approximation, shows a relation between a lens position and an addition signal in the second gain balance with function approximation, and specifies a lens position shown by an intersection of both functions as a lens position that equalizes the sizes of the respective light receiving areas ~~for receiving optical beam of the detection portions~~ in the light detection ~~unit~~ device.

23. (Currently Amended) The control device according to Claim 17, further comprising:

a subtraction unit operable to output a subtraction signal by calculating a difference between the first detection signal and the second detection signal whose gain balance is adjusted by the gain balance adjustment unit;

a subtraction signal amplifying unit operable to amplify the subtraction signal;
a gain balance adjustment unit operable to change the gain of the subtraction signal amplifying unit in response to the addition signal outputted from the addition unit;
and
a tracking control unit operable to control the lens shifting unit so that the optical beam can follow the tracks of the optical disc based on the subtraction signal amplified by the subtraction signal amplifying unit.

24. (Currently Amended) The control device according to Claim 16,
wherein the gain balance adjustment unit specifies the predetermined gain balance as the gain balance that equalizes the detection sensitivities of the respective ~~areas~~ detection portions in the light detection ~~unit~~ device in the case where a change rate of the addition signal on the lens position becomes “0” in the predetermined gain balance.

25. (Currently Amended) The control device according to Claim 16, further comprising:

a shifting control unit operable to control the lens shifting unit so that the convergence lens shifts to a first lens position and a second lens ~~positions~~ position;

wherein the gain balance adjustment unit shows a relation between a gain balance and an addition signal in the first lens position with function approximation, shows a relation between a gain balance and an addition signal in the second lens position with function approximation, and specifies a gain balance shown by an intersection of both functions as a gain balance that equalizes the detection sensitivities in the respective ~~areas~~ detection portions of the light detection ~~unit~~ device.

26. (Canceled)

27. (Canceled)

28. (Canceled)

29. (Currently Amended) A control signal generation circuit that generates a control signal for controlling an optical head of an optical disc apparatus for recording or playing back optical information on an optical disc,

wherein the optical head comprises:

a convergence lens for converging optical beam ~~that is irradiated on~~ onto the optical disc; and

a light detection device, including a first detection portion and a second detection portion ~~unit~~ operable to receive and detect the optical beam reflected by the optical disc on each ~~divided area~~ detection portion in a tracking direction, and output a first detection signal corresponding to a detected result from either one of the ~~divided areas~~ detection portions and a second detected signal corresponding to a detected result from the other ~~divided area~~ detection portion;

wherein the control signal generation circuit comprises:

an amplifying unit operable to change a gain balance by amplifying a first and a second detection signals using independent gains respectively; and

an output unit operable to add the first detection signal to the second detection signal in response to changes in gain balance made by the amplifying unit, ~~calculates~~ calculate a difference between the first detection signal and the second detection signal, and ~~outputs~~ output the control signal according to both of an operation results.

30. (Original) The control signal generation circuit according to Claim 29,

wherein the amplifying unit changes a gain of either one of the first detection signal and the second detection signal.

31. (Original) The control signal generation circuit according to Claim 29,

wherein the amplifying unit changes the gain balance so that the addition result of the gain to the first detection signal and the gain to the second detection signal becomes constant.

32. (Currently Amended) A control method for controlling an optical head of an optical disc apparatus for recording or playing back optical information on an optical

disc,

wherein the optical head comprises:

a convergence lens for converging optical beam ~~that is irradiated on~~ onto the optical disc;

a light detection device, including a first detection portion and a second detection portion ~~unit~~ operable to receive and detect the optical beam reflected by the optical disc on each ~~divided area~~ detection portion in a tracking direction, and output a first detection signal corresponding to a detected result from either one of the ~~divided areas~~ detection portions and a second detection signal corresponding to a detected result from the other ~~divided area~~ detection portion; and

a lens shifting unit operable to shift a light receiving area in the light detection ~~unit~~ device in a tracking direction by shifting the convergence lens in the tracking direction;

the control method comprising:

a gain balance changing step of changing the gain balance by amplifying the first and the second detection signals using independent gains respectively;

a lens shifting step of changing light receiving area in the light detection device ~~unit by shifting in a tracking direction~~ by shifting the convergence lens in the tracking direction;

an addition signal outputting step of outputting an addition signal by adding the first detection signal to the second detection signal in response to the shift in lens position and the change in gain balance in the gain balance changing step and the lens shifting step; and

a gain balance adjustment step of specifying the gain balance that equalizes the detection sensitivities of the respective ~~areas~~ detection portions in the light detection ~~unit~~ device based on the addition signal outputted in the addition signal outputting step, and ~~amplifies~~ amplifying the first and the second detection signals using the ~~determined~~ specified gain balance.

33. (Canceled)

34. (Canceled)

35. (New) A control device for controlling an optical head of an optical disc apparatus for recording or playing back optical information on the optical disc,

wherein the optical head comprises:

a convergence lens for converging an optical beam onto the optical disc;

a light detection device, including a first detection portion and a second detection portion, operable to receive and detect the optical beam reflected by the optical disc on each detection portion in a tracking direction, and output a first detection signal corresponding to a detected result from either one of the detection portions and a second detected signal corresponding to a detected result from the other detection portion; and

a lens shifting unit operable to shift a light receiving area in the light detection device in a tracking direction by shifting the convergence lens in the tracking direction;

the control device comprises:

an amplifying unit operable to change a gain balance by amplifying the first and the second detection signals using independent gains respectively;

an addition unit operable to output an addition signal by adding the first detection signal to the second detection signal in response to the shift in lens position of the convergence lens and the change in gain balance by the lens shifting unit and the amplifying unit; and

a lens position adjustment unit operable to obtain the addition signal outputted from the addition unit, specify a lens position that equalizes the sizes of respective light receiving areas of the detection portions in the light detection device based on the obtained result, and control the lens shifting unit so that the convergence lens shifts to the determined lens position.

36. (New) The control device according to Claim 35,

wherein the lens position adjustment unit specifies the determined lens position as a lens position that equalizes the sizes of the respective light receiving areas of the detection portions in the light detection device in the case where the addition signal becomes constant when the gain balance changes at the determined lens position.

37. (New) The control method according to Claim 32, further comprising:

a gain balance rechanging step of rechanging the gain balance by amplifying the first and the second detection signals using independent gains respectively based on the gains on the respective first and second detection signals in the gain balance adjusted in the gain balance adjustment step;

a lens position rechanging step of changing light receiving area in the light detection device in the tracking direction by resifting the convergence lens in the tracking direction;

an addition signal reoutputting step of outputting the addition signal by adding the first detection signal to the second detection signal in response to the shift in lens position of the convergence lens and the change in gain balance in the gain balance rechanging step and the lens position rechanging step; and

a lens position adjustment step of shifting the convergence lens to the determined lens position by specifying the lens position that equalizes sizes of the respective light receiving areas of the detection portions in the light detection device based on the addition result outputted in the addition signal reoutputting step.

38. (New) The control method according to Claim 32, further comprising:

a lens position adjustment step of shifting the convergence lens to the determined lens position by specifying the lens position that equalizes sizes of the respective light receiving areas of the detection portions in the light detection device based on the addition signal outputted in the addition signal outputting step.